BioInvasions Records (2020) Volume 9, Issue 2: 204–208

Rapid Communication

# The long reach of the Suez Canal: *Lagocephalus sceleratus* (Gmelin, 1789) an unwanted Indo-Pacific pest at the Atlantic gate

Ernesto Azzurro[1,2,*], Michel Bariche[3], Jacopo Cerri[4] and Joaquim Garrabou[5]

[1]*IRBIM-CNR, Institute of Biological Resources and Marine Biotechnologie, National Research Council, Ancona, Italy*
[2]*Stazione Zoologica Anton Dohrn, Naples, Italy*
[3]*American University of Beirut AUB, Beirut, Lebanon*
[4]*Institute for Environmental Protection and Research (ISPRA), Rome, Italy*
[5]*Institut de Ciències del Mar, ICM-CSIC, Barcelona, Spain*

Author e-mails: *eazzurr@gmail.com (EA), michel.bariche@aub.edu.lb (MB), jacopocerri@gmail.com (JC), garrabou@icm.csic.es (JG)*

**Corresponding author*

**Citation:** Azzurro E, Bariche M, Cerri J, Garrabou J (2020) The long reach of the Suez Canal: *Lagocephalus sceleratus* (Gmelin, 1789) an unwanted Indo-Pacific pest at the Atlantic gates. *BioInvasions Records* 9(2): 204–208, https://doi.org/10.3391/bir.2020.9.2.05

**Received:** 24 October 2019
**Accepted:** 5 February 2020
**Published:** 22 April 2020

**Thematic editor:** Stelios Katsanevakis



## Abstract

The silver-cheeked toadfish *Lagocephalus sceleratus* (Gmelin, 1789) is rapidly expanding westward through the Mediterranean Sea. On December 2017, a single individual was caught by a local fisherman at the westernmost end of the basin, the Straits of Gibraltar at San Amaro beach, Bahia norte, Ceuta, Spain (35.8974; −5.2994). This new record opens to the possibility of this Indo-Pacific pest to spread beyond the Mediterranean region, prospecting the future extension of Lessepsian bioinvasions to the Atlantic Ocean.

**Key words:** Lessepsian migration, Mediterranean Sea, Atlantic Ocean, geographical spread, biological invasions

## Introduction

The opening of the Suez Canal has caused dramatic consequences to the Mediterranean ecosystems, which are being progressively invaded by tropical species entering the eastern Mediterranean through the Suez Canal, a process generally known as Lessepsian migration. So far, more than one hundred fishes have entered the Mediterranean through this route, and the number is still increasing due to the continuous detection of newly introduced species (Golani et al. 2018). Among the most successful and unwanted new guests there is the silver-cheeked toadfish *Lagocephalus sceleratus* (Gmelin, 1789). This is a toxic pufferfish, one of the "worst" invaders of the Mediterranean Sea (Streftaris and Zenetos 2006) that has already caused severe ecological and socio-economic impacts in the Eastern sectors of the basin (Nader et al. 2012; Kalogirou 2013). Due to its content in tetrodotoxin, the species is highly toxic to consumption and many Mediterranean countries have carried out awareness initiatives to reduce the associated risks and to limit the impacts of this invasion (e.g. Souissi et al. 2014; Azzurro et al. 2016; Katikou 2019). Today, the consumption

of the silver-cheeked toadfish is illegal in many nations, including Japan and Malaysia where other pufferfish are traditionally (and legally) consumed. At the European level, European Regulations Directive 91/493/CEE, 853/2004/EC and 854/2004/EC have banned the marketing and consumption of the silver-cheeked toadfish and similar legislative measures have been adopted in other eastern Mediterranean countries (Sabrah et al. 2006; Halim and Rizkalla 2011; Nader et al. 2012). On July 27th 2011, Lebanese authorities (Decree 1/676) banned the fishing, transportation, selling and consuming of all pufferfish species, including *Lagocephalus* spp. and *Torquigener* spp (MB *personal comm.*). Notwhistanding these bans, the silver-cheeked toadfish is still marketed in several eastern countries, such as Egypt, Turkey and Lebanon (Nader et al. 2012; MB *personal comm.*) regardless of the risk it poses to public health.

## Materials and methods

On January 2018, the observation of a single individual of the silver-cheeked toadfish was posted to "Seawatchers" (http://www.seawatchers.net), a marine citizen science project web platform designed to collect citizen-generated data. The observation was posted within the "Invasive fish" project, which focuses on the distribution of non-indigenous fish species in the Mediterranean region and reports the occurrence of a number of target invaders. For each record, the system gives the possibility to upload one or more pictures together with additional relevant information (e.g. date, depth, geographical coordinates of the sighting and additional notes). A team of professional scientists with specific taxonomic expertise, act as editors and periodically verify-validate the records posted by each observer. The record was kept on stand-by until its validation, waiting for direct contacts with the registered observer and with the fisherman, which captured the fish.

## Results

The posted observation (Figure 1) corresponded to a single capture of the silver-cheeked toadfish *L. sceleratus*, which was realized on December 21th 2017. The individual was caught by a local recreational fisher along the coast of Gibraltar, at San Amaro beach, Bahia norte, Ceuta, Spain (35.8974; −5.2994). The photograph allowed the depiction of distinctive taxonomical characters, primarily the distinct wide silver band on the lower part of the flanks, the silver blotch in front of the eyes, the white belly and the spots of equal size regularly distributed along the dorsal area, in agreement with previous descriptions of this species (e.g. Akyol et al. 2005).

The fisher and the registered user were interviewed in June 2018 by phone and in the local language (Spanish) and a personal interview with the registered user confirmed the veracity of the posted observation. According


**Figure 1.** The silver-cheeked toadfish *Lagocephalus sceleratus*. Screenshot of the Gibraltar individual posted on the website *Seawatchers* (http://www.observadoresdelmar.es) by a registered observer and later validated by the *Seawatchers* scientific team (EA, MB, JG).

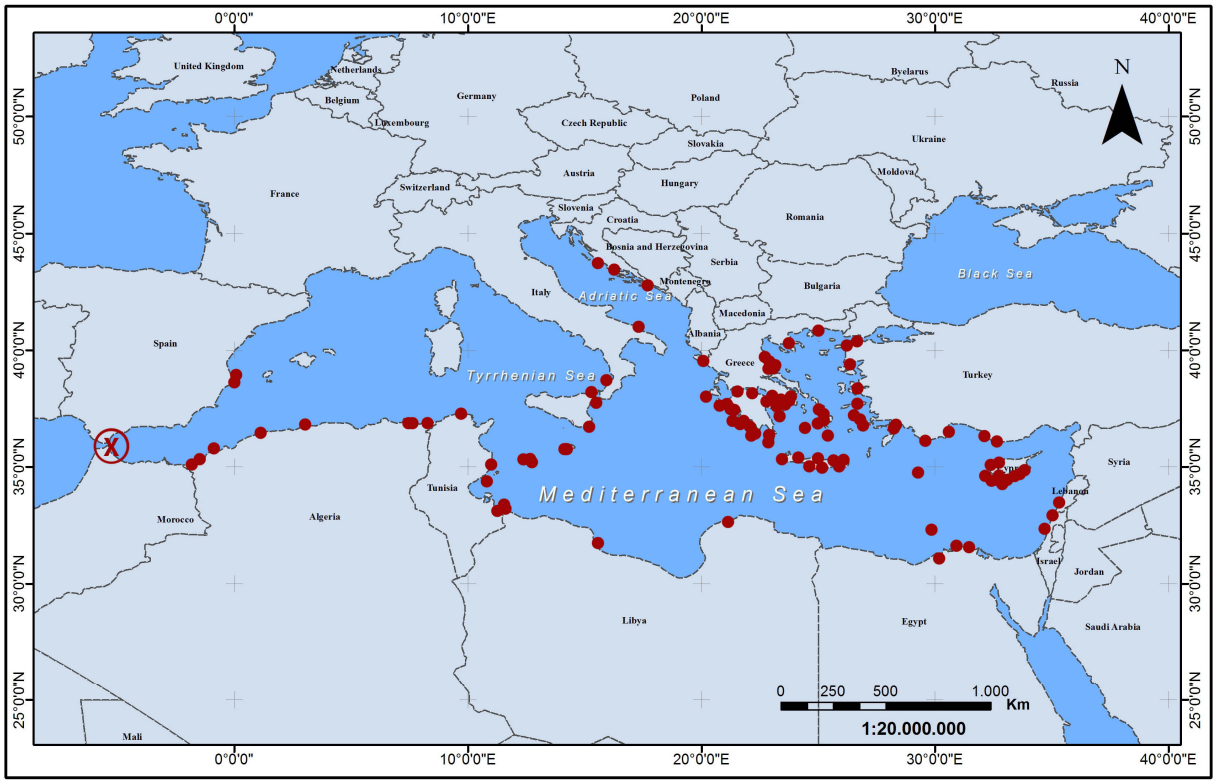


**Figure 2.** Occurrence records of the silver-cheeked toadfish *Lagocephalus sceleratus* in the Mediterranean Sea (modified from Coro et al. 2018), with indication of the present finding in the Straits of Gibraltar (circled cross).

to both the interviews and the information uploaded on *Seawatchers*, the capture was realized with hook-and-line in shallow water and the fish size was estimated to be around 50–60 cm TL and 3 kg of total weight. The

individual was photographed alive in a pool and was later discarded upon its death, at the end of the fishing day.

## Discussion

This new observation documents the spread of the silver-cheeked toadfish to the westernmost end of the Mediterranean Sea (Figure 2) but also opens to the possibility of this Indo-Pacific species to expand beyond the Mediterranean Sea, prospecting the future spread of Lessepsian bioinvasions to the Atlantic Ocean. So far, the potential of these species to invade Atlantic waters has been seldom considered (Bellwood and Goatley 2017), with modeling efforts typically limited to the Mediterranean region (see Coro et al. 2018 for *L. sceleratus*). Yet, this possibility needs to be seriously considered in light of the accelerated expansion of Lessepsian invaders under climate change scenarios (Marras et al. 2015; D'Amen and Azzurro 2019).

## Acknowledgements

We are indebted to Mr. Juan Manuel Postigo Toledo, the registered observer who posted the observation of *L. sceleratus* to the citizen science platform www.observadoresdelmar.es and was available to be interviewed and to provide information from the local fisherman. Also, we warmly thank Dr. Stelios Katsanevakis and two anonymous referees, whose comments significantly improved the quality of this manuscript.

## Funding declaration

This study has been partially supported by the Interreg Med Programme (Project MPA-Adapt - Grant number 1197 | 1MED15_3.2_M2_337 and Project MPA-ENGAGE -grant number: 5216 | 5MED18_3.2_M23_007).

## References

Akyol O, Ünal V, Ceyhan T, Bilecenoglu M (2005) First confirmed record of the silverside blaasop, *Lagocephalus sceleratus* (Gmelin, 1789), in the Mediterranean Sea. *Journal of Fish Biology* 66: 1183–1186, https://doi.org/10.1111/j.0022-1112.2005.00667.x

Azzurro E, Castriota L, Falautano M, Bariche M, Broglio E, Andaloro F (2016) New records of the silver-cheeked toadfish *Lagocephalus sceleratus* (Gmelin, 1789) in the Tyrrhenian and Ionian Seas: early detection and participatory monitoring in practice. *BioInvasions Records* 5: 295–299, https://doi.org/10.3391/bir.2016.5.4.16

Bellwood DR, Goatley, CHR (2017) Can biological invasions save Caribbean coral reefs? *Current Biology* 27: R13–R14, https://doi.org/10.1016/j.cub.2016.11.018

Coro G, Vilas LG, Magliozzi C, Ellenbroek A, Scarponi P, Pagano P (2018) Forecasting the ongoing invasion of *Lagocephalus sceleratus* in the Mediterranean Sea. *Ecological Modelling* 371: 37–49, https://doi.org/10.1016/j.ecolmodel.2018.01.007

D'Amen M, Azzurro E (2019) Lessepsian fish invasion in Mediterranean Marine Protected Areas: a risk assessment under climate change scenarios. *ICES Journal of Marine Science* 77: 388–397, https://doi.org/10.1093/icesjms/fsz207

Golani D, Orsi-Relini L, Massutí E, Quignard JP, Dulčić J, Azzurro E (2018) CIESM-Atlas of Exotic Fishes. http://www.ciesm.org/atlas/appendix1.html (accessed 10.10. 19)

Halim Y, Rizkalla S (2011) Aliens in Egyptian Mediterranean waters. A check-list of Erythrean fish with new records. *Mediterranean Marine Science* 12: 479–490, https://doi.org/10.12681/mms.46

Kalogirou S (2013) Ecological characteristics of the invasive pufferfish *Lagocephalus sceleratus* (Gmelin, 1789) in the eastern Mediterranean Sea - a case study from Rhodes. *Mediterranean Marine Science* 14: 251–260, https://doi.org/10.12681/mms.364

Katikou P (2019) Public Health Risks Associated with Tetrodotoxin and Its Analogues in European Waters: Recent Advances after The EFSA Scientific Opinion. *Toxins* 11: 240, https://doi.org/10.3390/toxins11050240

Marras S, Cucco A, Antognarelli F, Azzurro E, Milazzo M, Bariche M, Butenschön M, Kay S, Di Bitetto M, Quattrocchi G, Sinerchia M, Domenici P (2015) Predicting future thermal habitat suitability of competing native and invasive fish species: from metabolic scope to oceanographic modelling. *Conservation Physiology* 3: 1–14, https://doi.org/10.1093/conphys/cou059

Nader MR, Indary S, Boustany L (2012) The puffer fish *Lagocephalus scleratus* (Gmelin, 1789) in the Eastern Mediterranean. EastMed Technical Documents (FAO), 34 pp, http://www.fao.org/3/a-ap967e.pdf

Sabrah MM, El-Ganainy AA, Zaky MA (2006) Biology and toxicity of the pufferfish *Lagocephalus sceleratus* (Gmelin, 1789) from the Gulf of Suez. *Egyptian Journal of Aquatic Research* 32: 283–297

Souissi JB, Rifi M, Ghanem R, Ghozzi L, Boughedir W, Azzurro E (2014) *Lagocephalus sceleratus* (Gmelin, 1789) expands through the African coasts towards the Western Mediterranean Sea: a call for awareness. *Management of Biological Invasions* 5: 357–362, https://doi.org/10.3391/mbi.2014.5.4.06

Streftaris N, Zenetos A (2006) Alien Marine Species in the Mediterranean - the 100 "Worst Invasives" and their impact. *Mediterranean Marine Science* 7: 87–118, https://doi.org/10.12681/mms.180